

Accuracy Characteristics for ZDC Risk Reduction Scenario Hours 1700-2000

1 Introduction

This document contains scenario characteristics for hours 1700 to 2000 GMT recorded on October 11, 2000 at Washington ARTCC (ZDC). Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, and flight plan adherence. Definitions of the provided scenario characteristics are provided in Reference[1].

2 Reference

[1] Paglione,M., Oaks,R., Ryan,Dr. H., Summerill,J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

3 Center Airspace

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZDC Center using the October 11, 2000 ACES chart cycle. Information provided in Table 1 was gathered from running URET PRE and local knowledge.

Table 1: Center Airspace Characteristics

Metric	Definitions	Count
Airports	From URET DU Adaptation List	TBD
Sectors	From URET DU Adaptation List	TBD
SAA	Special Activities Airspace	TBD
APDIA	Automated Problem Detection Inhibited Area	TBD
SID	Standard Instrument Departure	TBD
STAR	Standard Arrival Route	TBD
PAR	Preferential Arrival Route	TBD
PDR	Preferential Departure Route	TBD
PDAR	Preferential Departure Arrival Route	TBD

4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

Table 2: Count of Current Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	132	49
$5 \leq d < 10$	151	52
$10 \leq d < 15$	249	88
$15 \leq d < 23$	597	219
$23 \leq d < 30$	500	187
Total	1629	595

Table 3: Count of Trial Plan Aircraft Encounters

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	132	43
$5 \leq d < 10$	151	43
$10 \leq d < 15$	249	70
$15 \leq d < 24$	685	223
$24 \leq d < 30$	412	137
Total	1629	516

4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

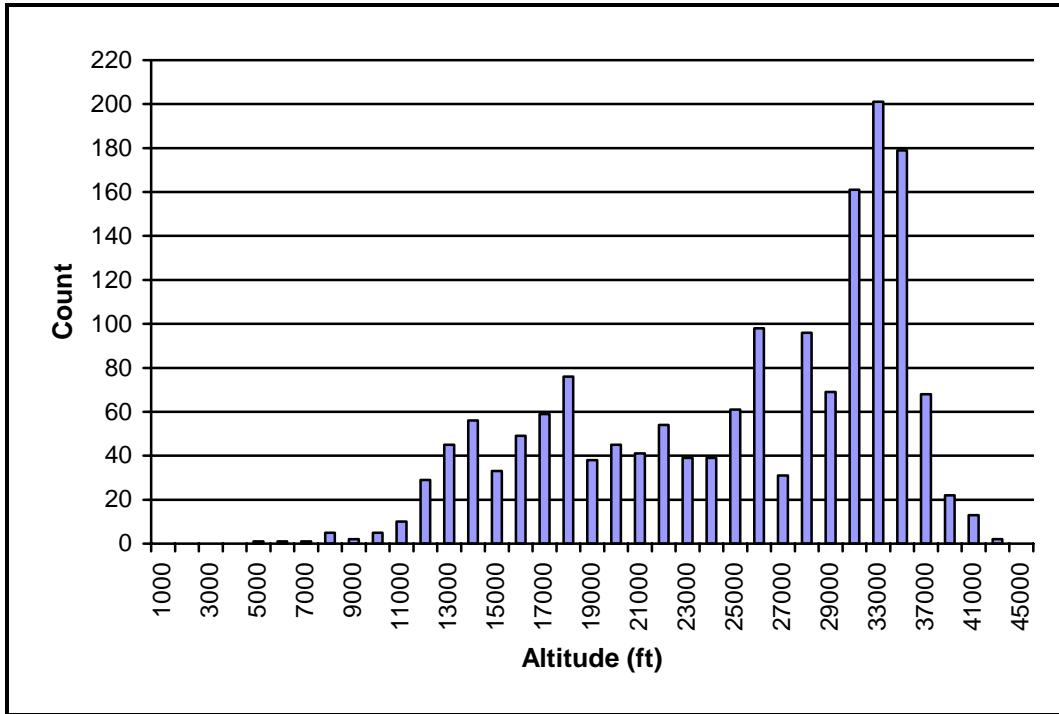


Figure 1: Aircraft to Aircraft Encounters by Altitude

4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 4: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	60	16	10	30	116
Descend-Descend	204	42	27	21	294
Climb-Climb	41	1	2	1	45
Cruise-Climb	174	28	12	81	295
Cruise-Descend	326	103	58	190	677
Climb-Descend	61	32	9	73	175
Unknown	24	1	1	1	27
Total	890	223	119	397	1629

5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

Table 5: Count of Current Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts ¹	120	59
$d = 0^2$	97	59
$0 < d < 7$	601	372
$7 \leq d < 9$	168	111
$9 \leq d < 11$	182	118
$11 \leq d < 16$	385	234
$16 \leq d < 30$	1297	798
Total	2850	1751

Table 6: Count of Trial Plan Airspace Encounters by Horizontal Separation

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts ³	120	55
$d = 0^4$	97	10
$0 < d < 8$	676	320
$8 \leq d < 11$	275	129
$11 \leq d < 13$	175	81
$13 \leq d < 19$	436	187
$19 \leq d < 30$	1071	454
Total	2850	1236

¹ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

² This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

³ This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

⁴ This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

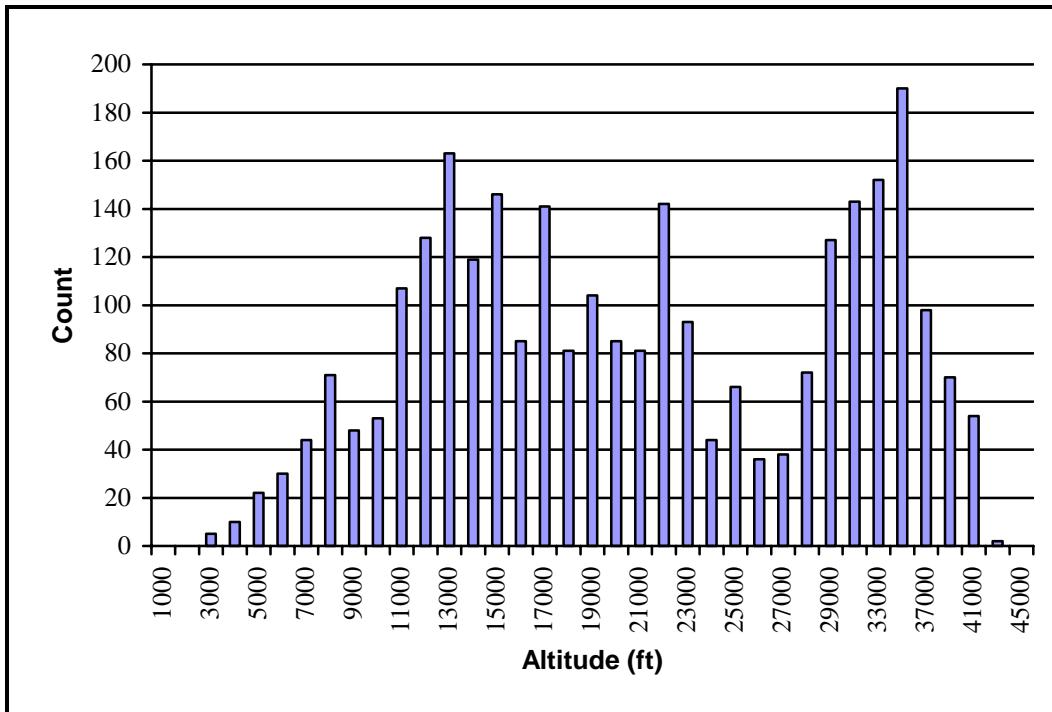


Figure 2: Airspace to Airspace Encounters by Altitude

5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	2	5	0	7
Cruise	22	30	23	75
Descend	15	4	7	26
Total	39	39	30	108

Table 8: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	0	0	0	0
Cruise	0	1	0	1
Descend	4	0	0	4
Total	4	1	0	5

Table 9: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles

Vertical Phase	Count
Climb	3
Cruise	3
Descend	1
Total	7

6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

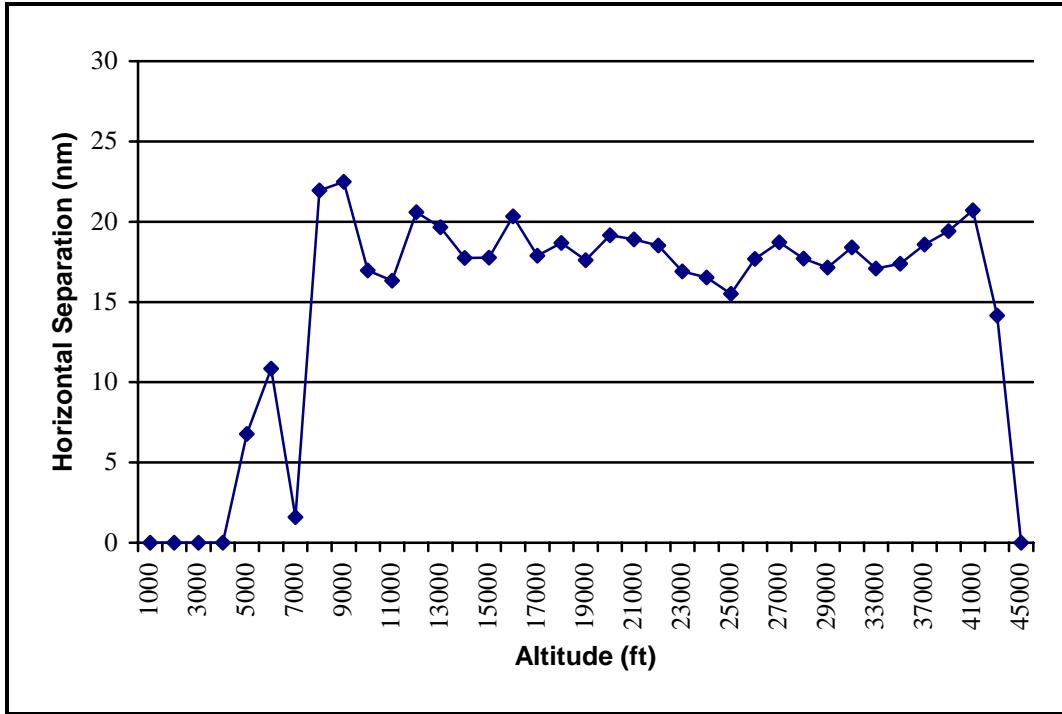


Figure 3: Average Horizontal Separation by Altitude for All Hours

6.2 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

Table 10: Statistics on Active Flights per Minute Increment

Count Average	Standard Deviation	Maximum Count	Minimum Count
117.194	136.807	341	0

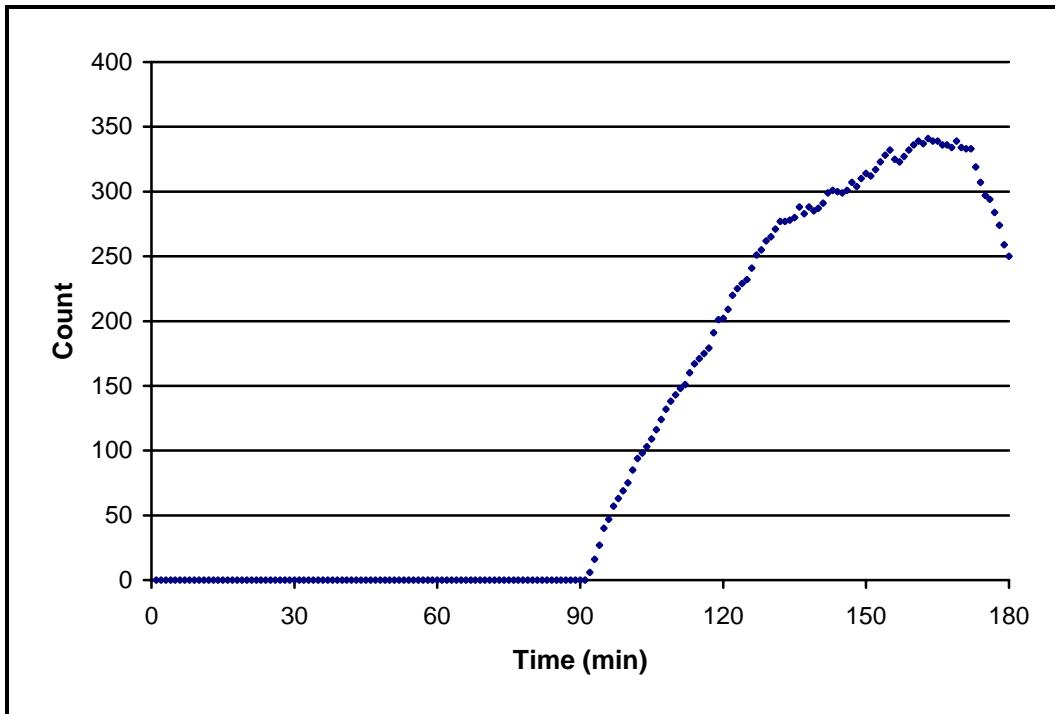


Figure 4: Count of Active Flights per Minute Increment

6.3 Flight Type and Sector Penetration

This section corresponds to Section 3.3.3 of Reference[1].

Table 11: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.399	2.278	2.357	2.425	2.363
Average Time in Center (sec)	1428.814	1532.778	1255.974	1542.500	1378.192
Average Time in Sector (sec)	587.002	667.317	521.818	631.134	574.354
Percentage by Flight Type	34.700	17.300	42.200	5.500	100.000

6.4 Ground Speed

This section corresponds to Section 3.3.4 of Reference[1]. Detailed statistics on aircraft ground speed are provided in Appendix B.

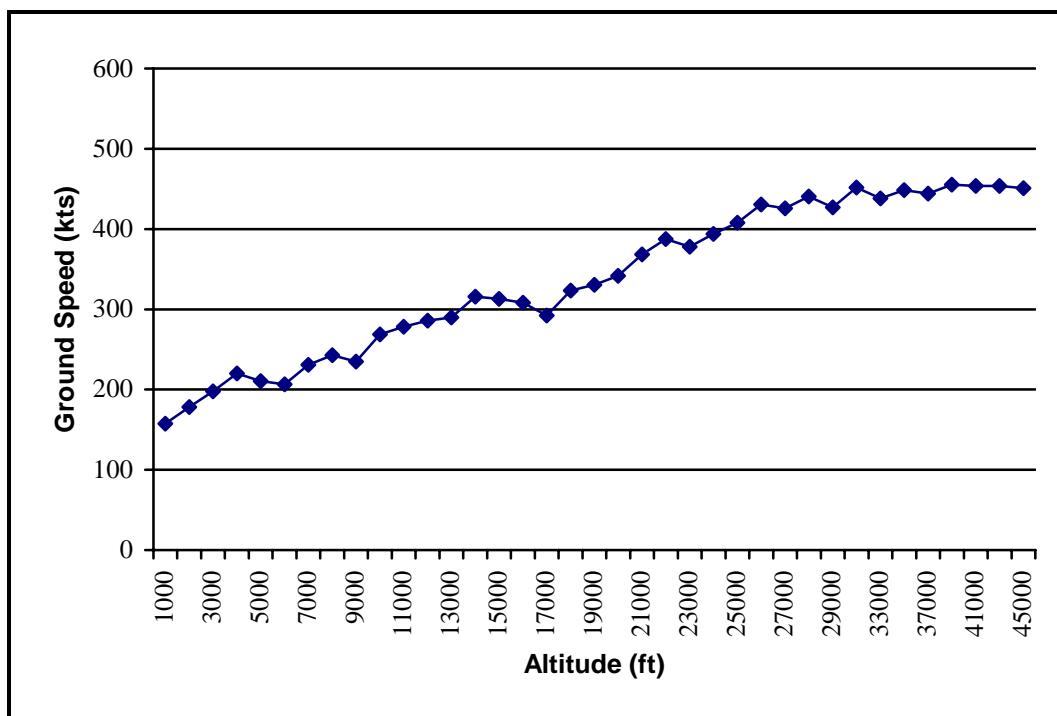


Figure 5: Average Ground Speed by Altitude for All Hours

6.5 Center to APD Ratio

This section corresponds to Section 3.3.5 of Reference[1].

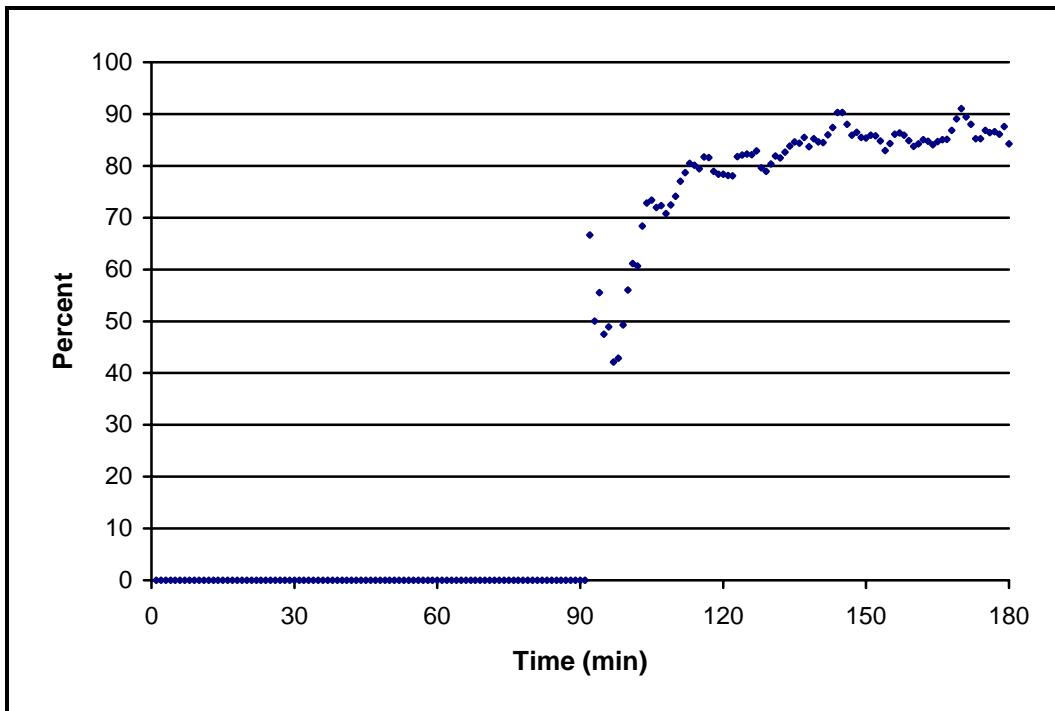


Figure 6: Percentage of Track Points in Center to APD Zone per Minute Increment

6.6 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 12: Statistics on Interim Altitude Messages⁵

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
341	2.657	0.922	6	1

6.7 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 13: Statistics on Amendment Messages per Flight⁶

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
498	2.763	1.825	13	1

⁵ Statistics on flights with interim altitude messages only

⁶ Statistics on flights with flight plan amendments only

6.8 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

Table 14: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	2772	898	3670
DES	7222	1388	8610
LEV	1928	999	2927
Total	11922	3285	15207

Table 15: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	18.228	5.905	24.134
DES	47.491	9.127	56.619
LEV	12.678	6.569	19.248
Margin (%)	78.398	21.602	100.000

7 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

7.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

Table 16: Count by Aircraft Type

Aircraft Type	Count	Percentage of Total
J	557	75.270
P	25	3.378
T	145	19.595
Unknown	14	1.757
Total	741	100.000

7.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1]. A full listing and count of aircraft models is provided in Appendix D.

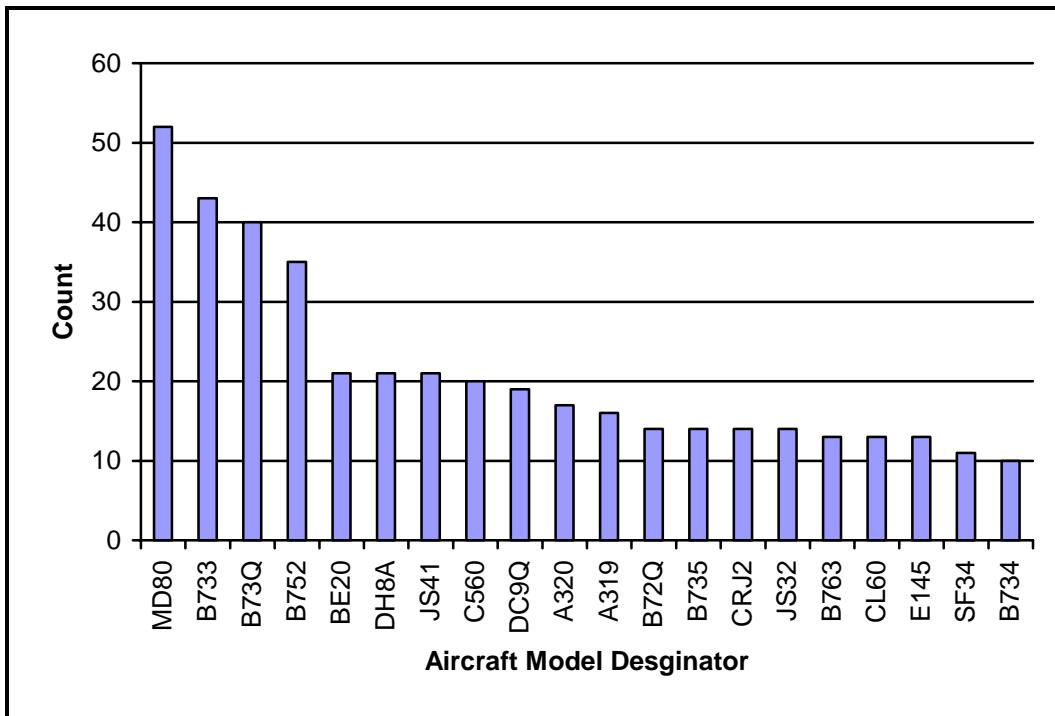


Figure 7: Count of Top Twenty Aircraft Models

7.3 Navigational Equipage

This section corresponds to Section 3.4.3 of Reference[1].

Table 17: Count by Aircraft Navigational Equipage Type

Nav. Equip. Designator	Count	Percentage of total
G	150	20.243
A	148	19.973
I	133	17.949
F	125	16.869
E	120	16.194
R	29	3.914
W	22	2.969
P	7	0.945
Q	3	0.405
U	4	0.540
Total	741	100.000

7.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

Table 18: Count by Carrier Type

Category	Count	Percentage of Total
Commercial	511	68.961
General Aviation	175	23.617
Other ⁷	55	7.422
Total	741	100.000

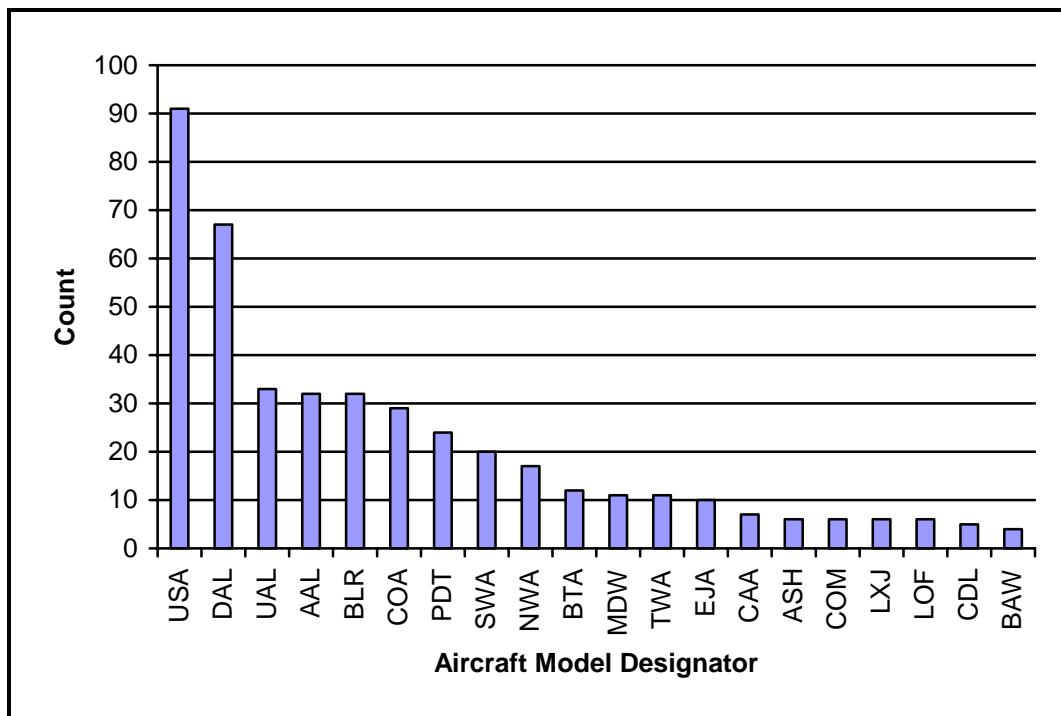


Figure 8: Count by Top Twenty Air Carriers

⁷ Includes military and aircraft with unrecognized designators

8 Flight Plan Adherence

This section provides statistics on lateral and vertical flight plan adherence and corresponds to Section 3.5 of Reference[1].

8.1 Lateral Flight Plan Adherence

This section corresponds to Section 3.5.1 of Reference[1].

Table 19: Statistics on Lateral Flight Plan Adherence by Altitude⁸

Upper Altitude (ft)	Flight Count	Max. Dist. Out (nm)	Min. Dist. Out (nm)	Average Dist. Out (nm)	Standard Dev.(nm)
10000	36	359	11	28.524	42.275
18000	17	358	13	68.696	105.294
33000	58	328	13	45.641	62.387
45000	52	264	14	45.629	39.099
Total	163				

8.2 Vertical Flight Plan Adherence

This section corresponds to Section 3.5.2 of Reference[1].

Table 20: Statistics on Vertical Flight Plan Adherence by Altitude⁹

Upper Altitude (ft)	Flight Count	Max. Dist. Out (ft)	Min. Dist. Out (ft)	Average Dist. Out (ft)	Standard Dev.(ft)
29000	423	33434	329	5150.855	4198.279
45000	120	13000	600	4759.022	2418.470
Total	543				

⁸ Statistics determined on tracks out of lateral adherence only.

⁹ Statistics were determined on tracks out of vertical adherence only.

Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

Table 21: Statistics on Aircraft Encounters by Altitude Interval for All Hours

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	0	0.000	0.000
5000	1	6.769	0.000
6000	1	10.838	0.000
7000	1	1.585	0.000
8000	5	21.955	7.340
9000	2	22.481	4.610
10000	5	16.959	9.438
11000	10	16.334	10.571
12000	29	20.600	7.227
13000	45	19.650	6.595
14000	56	17.742	8.375
15000	33	17.766	7.546
16000	49	20.333	6.512
17000	59	17.871	7.359
18000	76	18.684	7.950
19000	38	17.610	5.806
20000	45	19.166	6.073
21000	41	18.894	5.807
22000	54	18.512	6.499
23000	39	16.895	7.374
24000	39	16.515	9.210
25000	61	15.508	7.643
26000	98	17.674	8.087
27000	31	18.726	7.103
28000	96	17.695	8.163
29000	69	17.135	7.484
31000	161	18.402	7.645
33000	201	17.090	7.778
35000	179	17.374	8.385
37000	68	18.572	7.419
39000	22	19.411	5.885
41000	13	20.719	6.266
43000	2	14.157	1.065
45000	0	0.000	0.000
Total	1629		

Appendix B: Supplement to Section 6.4 - Aircraft Ground Speed

Table 22: Statistics on Ground Speed by Altitude for All Hours

Upper Altitude (ft)	Distinct Aircraft	Average Speed (kts)	Standard Dev.(kts)
1000	9	157.289	41.959
2000	37	178.258	55.384
3000	87	197.738	50.147
4000	144	220.191	47.208
5000	194	210.572	50.997
6000	269	206.684	60.386
7000	296	231.004	47.035
8000	346	242.703	51.113
9000	366	234.818	57.287
10000	378	268.852	55.148
11000	417	278.458	67.884
12000	429	285.733	68.538
13000	423	289.828	69.482
14000	422	315.820	67.800
15000	416	312.785	70.269
16000	404	308.253	76.286
17000	393	292.140	77.674
18000	382	323.344	76.292
19000	382	330.380	79.919
20000	369	341.752	73.248
21000	357	368.346	73.478
22000	350	387.542	61.422
23000	347	378.092	70.248
24000	339	393.973	63.732
25000	332	407.954	62.709
26000	320	430.502	61.620
27000	316	425.967	59.330
28000	309	440.344	41.850
29000	295	427.037	50.563
31000	290	451.558	31.605
33000	247	438.126	26.865
35000	184	448.351	28.925
37000	103	444.052	34.640
39000	48	455.468	30.300
41000	29	453.856	26.642
43000	6	453.507	17.089
45000	1	451.000	0.000

Appendix C: Supplement to Section 6.8 - Air Traffic Maneuvers

Table 23: Count of Maneuvers by Altitude, Vertical and Horizontal Phase of Flight

Upper Altitude (ft)	Vertical Phase	Horizontal Phase of Flight	
		STR	TURN
1000	ASC	4	8
	DES	1	2
	LEV	4	6
2000	ASC	7	13
	DES	0	2
	LEV	22	29
3000	ASC	15	22
	DES	14	6
	LEV	50	44
4000	ASC	29	27
	DES	26	21
	LEV	93	61
5000	ASC	48	34
	DES	37	42
	LEV	115	64
6000	ASC	68	62
	DES	42	49
	LEV	178	82
7000	ASC	45	26
	DES	59	49
	LEV	205	74
8000	ASC	60	41
	DES	74	44
	LEV	241	84
9000	ASC	60	37
	DES	71	41
	LEV	267	86
10000	ASC	57	30
	DES	85	50
	LEV	286	86
11000	ASC	116	43
	DES	102	49
	LEV	306	103
12000	ASC	83	33
	DES	118	51
	LEV	318	72

13000	ASC	39	19
	DES	121	40
	LEV	321	50
14000	ASC	48	21
	DES	128	43
	LEV	314	48
15000	ASC	71	20
	DES	119	44
	LEV	313	53
16000	ASC	41	15
	DES	116	29
	LEV	301	46
17000	ASC	41	18
	DES	119	27
	LEV	295	31
18000	ASC	36	12
	DES	107	28
	LEV	292	31
19000	ASC	37	20
	DES	106	31
	LEV	286	34
20000	ASC	33	15
	DES	105	23
	LEV	287	28
21000	ASC	60	15
	DES	105	20
	LEV	272	15
22000	ASC	55	30
	DES	106	18
	LEV	263	22
23000	ASC	50	20
	DES	104	16
	LEV	252	26
24000	ASC	68	14
	DES	101	22
	LEV	250	32
25000	ASC	78	21
	DES	100	18
	LEV	246	24
26000	ASC	34	14
	DES	101	23

	LEV	237	20
27000	ASC	55	22
	DES	97	16
	LEV	230	15
28000	ASC	56	25
	DES	94	13
	LEV	226	15
29000	ASC	88	34
	DES	94	17
	LEV	211	12
31000	ASC	103	54
	DES	102	27
	LEV	186	25
33000	ASC	123	86
	DES	78	11
	LEV	158	23
35000	ASC	106	74
	DES	71	17
	LEV	87	19
37000	ASC	55	30
	DES	33	3
	LEV	62	18
39000	ASC	28	18
	DES	25	2
	LEV	27	6
41000	ASC	24	20
	DES	9	2
	LEV	19	4
43000	ASC	6	6
	DES	2	2
	LEV	2	0
45000	ASC	1	0
	DES	0	0
	LEV	0	0

Appendix D: Supplement to Section 7.2 - Aircraft Models

Table 24: Count and Percentage of Aircraft by Model Type

Model Type	Aircraft Count	Percent of Total
MD80	52	7.018
B733	43	5.803
B73Q	40	5.398
B752	35	4.723
BE20	21	2.834
DH8A	21	2.834
JS41	21	2.834
C560	20	2.699
DC9Q	19	2.564
A320	17	2.294
A319	16	2.159
B72Q	14	1.889
B735	14	1.889
CRJ2	14	1.889
JS32	14	1.889
B763	13	1.754
CL60	13	1.754
E145	13	1.754
SF34	11	1.484
B734	10	1.350
C650	10	1.350
B722	9	1.215
BE9L	9	1.215
C550	9	1.215
F100	9	1.215
B737	8	1.080
LJ35	8	1.080
B772	7	0.945
H25B	7	0.945
B738	6	0.810
B762	6	0.810
CARJ	6	0.810
CRJ1	6	0.810
DC9	6	0.810
DH8B	5	0.675
E135	5	0.675
F15	5	0.675

GLF4	5	0.675
LJ60	5	0.675
C130	4	0.540
C210	4	0.540
C421	4	0.540
C750	4	0.540
D328	4	0.540
E120	4	0.540
F2TH	4	0.540
FA20	4	0.540
GLF2	4	0.540
J328	4	0.540
LJ24	4	0.540
LJ25	4	0.540
LJ31	4	0.540
WW24	4	0.540
A330	3	0.405
AT43	3	0.405
B190	3	0.405
B744	3	0.405
BE30	3	0.405
BE36	3	0.405
BE40	3	0.405
BE58	3	0.405
F18	3	0.405
F900	3	0.405
GLF3	3	0.405
H25C	3	0.405
S3	3	0.405
n/a	3	0.405
A306	2	0.270
ASTR	2	0.270
B721	2	0.270
B727	2	0.270
B732	2	0.270
BE10	2	0.270
BE33	2	0.270
C141	2	0.270
C182	2	0.270
C2	2	0.270
C5	2	0.270
C525	2	0.270

DH8C	2	0.270
E2	2	0.270
F16	2	0.270
JS31	2	0.270
K35R	2	0.270
LJ36	2	0.270
LJ45	2	0.270
LJ55	2	0.270
LR31	2	0.270
MD11	2	0.270
PAY1	2	0.270
PAY2	2	0.270
SBR1	2	0.270
A340	1	0.135
AT72	1	0.135
B350	1	0.135
B703	1	0.135
B712	1	0.135
B72G	1	0.135
B741	1	0.135
B742	1	0.135
B757	1	0.135
BD9L	1	0.135
BE90	1	0.135
BE9F	1	0.135
BE9T	1	0.135
C135	1	0.135
C172	1	0.135
C206	1	0.135
C340	1	0.135
C441	1	0.135
C500	1	0.135
DA50	1	0.135
DC10	1	0.135
E2C	1	0.135
E3TF	1	0.135
F28	1	0.135
FA50	1	0.135
FA90	1	0.135
G3	1	0.135
H25A	1	0.135
HS25	1	0.135

LR25	1	0.135
M20P	1	0.135
MD90	1	0.135
MU30	1	0.135
P180	1	0.135
P28R	1	0.135
PA32	1	0.135
PA34	1	0.135
PAY3	1	0.135
S3B	1	0.135
SW3	1	0.135
T70	1	0.135
Total	741	100.000